

LAUGHING JACK DAM

Tasmania

Submission for an

HISTORIC ENGINEERING MARKER

from

The Engineering Heritage Committee

Tasmania Division

The Institution of Engineers, Australia

April 2000

LAUGHING JACK DAM

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INTRODUCTION

Laughing Jack Dam impounds the flow in Powers Rivulet. Controlled releases flow down into the Clarence River and thence to the Tungatinah Power Station.

Completed in 1957, the dam is a rockfill embankment with a sloping earth core as the impervious element.

The unique feature of this structure is its internal spillway. Flood waters flow into the embankment, pass over a concrete capping on top of the clay core, flow down through the voids in the rockfill and emerge at the downstream toe.

This innovative design was put forward by John Wilkins, Engineer for Civil Design in the Hydro-Electric Commission, and was developed into a safe and practical prototype with the aid of hydraulic model testing.

Commemorative Plaque Nomination Form

Date.....*April 2000*

To:

Commemorative Plaque Sub-Committee
The Institution of Engineers, Australia
Engineering House
11 National Circuit
BARTON ACT 2000

From.. *Tasmania Division*
(Nominating Body)

The following work is nominated for a *Historic Engineering Marker*

Name of work.....*LAUGHING JACK DAM*

Location, including address and map grid reference if a fixed work:

*On Powers Rivulet 14km west of Bronte Park on Tasmania's central plateau. Aust
Map 1:100 000 "Nive" sheet Grid Ref E 444700 N 533020*

Owner*The Hydro-Electric Corporation, Tasmania*

The owner has been advised of the nomination of the work and has indicated (attach a copy of letter if available) *Copy attached*

Access to site*By road*

Future care and maintenance of the work:

Maintained by the Hydro-Electric Corporation

Name of sponsor...*Engineering Heritage Committee*

For a NEL, is an information plaque required?... *Not applicable*

.....
Chairperson of Nominating Committee

.....
Chairperson of Division Heritage Committee

ADDITIONAL SUPPORTING INFORMATION

Name of work.....**LAUGHING JACK DAM**

Year of construction or manufacture.....**Completed in 1957**

Period of operation.....**Continuous since 1957**

Physical condition**Very good**

ENGINEERING HERITAGE SIGNIFICANCE:

Technological/scientific value **Rockfill dam with a unique flow-through spillway**

Historical value**Example of innovative engineering design**

Social value **High interest for engineers and industrial archaeologists**

Landscape or townscape value.....**Nil**

Rarity**Spillway design unique in Australia**

Representativeness**Not applicable**

Contribution to the nation or region...**Economical structure for power generation**

Contribution to engineering

.....**Innovative application of an idea supported by detailed hydraulic model tests**

Persons associated with the work

.....**J K Wilkins, Engineer for Civil Design, HEC, Tasmania.**

Integrity**Original condition**

Authenticity..... **Complete**

Comparable works (a) in Australia **Possibly two or three later examples**

(b) overseas **Probably less than five.**

Statement of significance, its location in the supporting doco...**Next page**

Citation (70 words is optimum).....

HISTORIC ENGINEERING MARKER

LAUGHING JACK DAM

THIS CLAY CORE AND ROCKFILL DAM, COMPLETED IN 1957, HAS A SPILLWAY WHICH ALLOWS FLOOD WATER TO FLOW THROUGH THE ROCKFILL AND OUT THE DOWNSTREAM TOE OF THE EMBANKMENT. INSIDE THE DAM THE CLAY CORE IS PROTECTED FROM EROSION BY A CONCRETE CAP. PROPOSED BY JOHN WILKINS, ENGINEER FOR CIVIL DESIGN IN THE HYDRO-ELECTRIC COMMISSION, THE DESIGN WAS TESTED ON MODEL EMBANKMENTS IN A HYDRAULICS LABORATORY. THIS DESIGN WAS THE FIRST IN AUSTRALIA. (73 words)

Dedicated by the Institution of Engineers, Australia

2001

Attachments to submission (if any).....**See contents**

Proposed location of plaque (if not a site).....**Not applicable**

LAUGHING JACK DAM

STATEMENT OF SIGNIFICANCE

Laughing Jack Dam is a rare example, on a world-wide basis, of an earth and rockfill dam in which flood water is designed to flow through the rockfill. It is estimated that there are less than five examples in the world of permanent dams with this design.

The internal spillway was adopted for Laughing Jack Dam by the Engineer for Civil Design in the Tasmanian Hydro-Electric Commission, Mr John Wilkins, because the site topography made a conventional spillway too expensive. Detailed model tests in a hydraulics laboratory were required to assess the flow which could pass through the rockfill voids without endangering the stability of the dam.

Mr Wilkins' careful investigations and commitment to the unusual spillway design has resulted in a dam that has performed satisfactorily for over forty years.

NOTE

This statement is supported by three extracts from the Nomination for Listing on the Register of the National Estate (pages 3, 4 and 7).

2. DESCRIPTION

2.1 The Place

Laughing Jack Dam is located on the upper reaches of Powers Rivulet north of the Wentworth Hills on Tasmania's central plateau. The area is 100km to the north-west of Hobart and a similar distance to the south-west of Launceston. The country around the dam is at the relatively high altitude of about 700m and winter frosts and snowfalls are common.

Geologically the bedrock is the massive dolerite which is found throughout the central plateau. Glaciation in pleistocene times has resulted in deep weathering of this dolerite. The topographical relief of the area is slight with low stoney hills. The hills are covered with an open forest of snow gums, swamp peppermint, mountain white gum and cider gum with little undergrowth. The valleys are quite marshy but open with tussocky native grasses and some button grass. The whole effect from a distance is very park-like.

Laughing Jack Dam is now just over forty years old. It is in reasonable condition and has operated satisfactorily without modification since its commissioning. It continues to divert water into the Clarence River and thence into the Clarence pipeline and ultimately contributes to the generation of power at the Tungatinah Power Station.

2.2 Historical Summary

The central plateau area was explored by William Sharland, an assistant government surveyor, in 1832. Laughing Jack Marsh, which was flooded by the dam lagoon, was first recorded on an 1851 road plan of the area. It was probably named after an early settler in the district but apparently was not named after the Kookaburra or Laughing Jackass which was only introduced to Tasmania in about 1907.

The area was subsequently used for general grazing although the expected population influx did not eventuate. In 1932 the Lyell Highway between Hobart and Queenstown was completed and this highway passes just to the north of the Laughing Jack area. After the second world war Tasmania began to expand its hydro-electric generating capacity to provide a base for industrial development in the state. The Tungatinah Power Development was one of the first schemes to be started in this period. A construction village was built at Bronte Park to house workers and their families for the development and it was from this village that Laughing Jack Dam was constructed. Laughing Jack Dam was completed in 1957 as the final major structure in the Tungatinah Power Development. By 1960 all the construction activities in the area were completed and most of Bronte Park was dismantled. Today there are still a few people living in the village which is a popular tourist stop over.

2.3 Historical Biography

Laughing Jack Dam was designed and constructed by the Tasmanian Hydro-Electric Commission. The use of an internal spillway in the dam was an idea of John Wilkins who was the Commission's chief civil design engineer at the time.

John Kirby Wilkins, B.Sc Eng (Hons), Dip Struct Eng., F.I.C.E., F.I.E.Aust.(1912-96) worked in the UK from 1931 to 1950 apart from service in France and Malta during the second world war. In 1950 he joined the HEC as Head of the Civil Design Division and held that position until 1974 when he became Chief Civil Engineer. In this period the Division designed 19 hydro-electric power schemes with an installed capacity of 1500MW and including 19 large dams, a mammoth achievement in any terms. He was an outstanding

engineer with an international reputation. He represented the HEC at a number of National and International Conferences and was the author or co-author of 14 technical papers and articles. He was awarded the Warren Prize and Chapman Medal by the Institution of Engineers, Australia in 1969.

2.4 Technical Description

Dam Type	Rockfill with an impermeable inclined clay core
Height	17 m
Length	170 m
Volume of Fill	59 000 m ³
Spillway Type	Internal through the rockfill of the dam over a 55m wide concrete capping at the top of the clay core
Spillway Capacity	Nominal maximum 28 m ³ /s
Lake Volume	25 000 ML
Lake Area	3 km ²

A unique feature of Laughing Jack Dam is the internal spillway which allows flood water to flow over a 55m wide concrete capping at the top of the clay core within the dam and through the downstream rockfill zone of the dam. All dams require a spillway to allow floodwaters to pass the dam. Usually these spillways are separate structures adjacent to the dam but, at Laughing Jack, the narrow gorge site made a conventional spillway awkward to construct and thus expensive. The idea was thus suggested of spilling floodwater through the rockfill. This idea was developed, with the aid of hydraulic model testing, into an appropriate design which would ensure that floodwater flowing through the dam would not disrupt the rockfill.

2.5 Illustrations

- (a) Colour photograph: Upstream face of dam
- (b) Colour photographs: Downstream face of dam

See also the attachments.

3. STATEMENTS OF SIGNIFICANCE

Laughing Jack Dam's claim for National Estate registration is primarily based on the technical significance of its flow-through spillway.

CRITERION B2

Design no longer practised but of exceptional interest

Very few rockfill dams worldwide use an internal spillway like that at Laughing Jack. Today dam designers are more conscious of risk and liability in their work and they would probably not consider using this type of flow-through spillway despite the success of Laughing Jack. The Laughing Jack Dam is thus an example of a design no longer practised but which has exceptional interest for civil engineers, historians and tourists.

CRITERION F1

Importance for its technical innovation

The internal spillway in the Laughing Jack Dam is an example of innovative technical design which is almost without precedent in modern dam building practice. This unusual design was constructed and has operated successfully in the Laughing Jack Dam for 40 years.

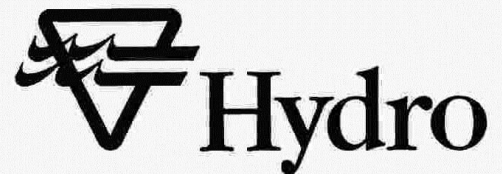
CRITERION H1

Importance for close association with an individual whose activities have been significant for the history of professional engineering in Australia

This dam is a tribute to an ingenious idea developed by John Wilkins who was the chief civil design engineer of the Hydro-Electric Commission at the time. He had taken a close interest in the flow of water through rockfill for some years and oversaw the hydraulic model tests required to show that the proposal was safe.

4. REFERENCES

1. Hydro-Electric Commission, *Design Report on Laughing Jack Marsh Dam*, Internal Civil Design Report No. CDR 13, March 1961.
2. Hydro-Electric Commission, *Construction Report - Laughing Jack Dam*, Internal Civil Construction Report No. CCR 19, May 1958.
3. J K Wilkins, 'Flow of Water through Rockfill and its Application to the Design of Dams', *Proceedings of the 2nd ANZ Conference on Soil Mechanics and Foundation Engineering*, Christchurch, 1956.
4. Obituary, 'John Kirby Wilkins, Engineer of Gordon River Dam' *The Australian*, Time and Tide, 22 January 1997.



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Our Ref.

Your Ref.

Ask for

24 February 2000

Mr K C Drewitt
Chairman
Engineering Heritage Committee
The Institute of Engineers
2 Davey Street
Hobart Tas 7000

Dear Mr. Drewitt,

Thank you for your correspondence of 14 February 2000, advising of the eight dams which have recently been nominated for national heritage listing on the National Estate Register.

The Hydro is very pleased to approve the nominations and we look forward to hearing the outcome of the proposed public recognition awards.

With kind regards,

Yours sincerely,

Roger Gill
Generation Manager Generation

c.c. Andrew Pattle, Dam Safety Manager
Peter Grierson, Manager Power Schemes

LAUGHING JACK DAM

AUSTRALIA



TYPE: Rockfill with clay core
HEIGHT: 17 m **CREST LENGTH:** 170 m
EMBANKMENT VOLUME: 59 000 m³
STORAGE VOLUME: 25 million m³
SPILLWAY CAPACITY: 28 m³/s
COMPLETED: 1957
OWNER: Hydro-Electric Commission of Tasmania

Part of the Tungatinah Power Development in central Tasmania, Laughing Jack Dam impounds the highly seasonal flow of a small stream and diverts it through several other lakes of the scheme and ultimately to Tungatinah Power Station.

The embankment has batters of 1:1.33, with additional berms of large rocks against the upstream face and at the downstream toe. The inclined clay core is a uniform 2 metres thick, and is located under the upstream face. It also extends as an upstream blanket some 15 metres horizontally, beneath the upstream berm. The top of the core is just above full supply level; above this an inclined reinforced concrete slab extends within the dam from the top edge of the core to the dam crest.

Because of the high hydraulic gradient through the slim core, the filter zones consist of four layers, though still with a total thickness of only 0.8 metre. The filter zones cover both sides and the top of the core, and also extend over the top of the upstream clay blanket and over the entire foundation area downstream of the core.

The spillway is an ungated weir hidden inside the dam. Over a central 55 metres length of the crest, the concrete slab is dipped over the top of the core, within the embankment. Spill percolates through the crest rockfill in this region and down through the body of the dam; at the nominal spillway capacity, the flood rise is estimated at 1.5 metres, preserving 0.9 metres freeboard.

Services Provided

Feasibility study, investigations, detailed design, documentation, supervision of construction, operation and maintenance.

FIGURE 1





Laughing Jack Dam – upstream face



Laughing Jack Dam – downstream face



